Contaminant Robust System for Oxygen Production from Lunar and Martian Resources, Phase II

Completed Technology Project (2011 - 2013)

Project Introduction

Extended duration missions to the Moon and Mars will require the use of In-situ resources to generate propellants and life support consumables. Many of the processes for in-situ resource utilization (ISRU) produce water, along with a variety of acid gases and other water soluble contaminants. Paragon proposes to develop membrane technology to separate water vapor from contaminants in the ISRU systems. The water vapor can then be processed using Paragon's demonstrated Solid Oxide Electrolysis (SOE) technology to produce pure gaseous oxygen for life support and/or propulsion. The membrane and SOE subsystem has no moving parts, require no regeneration or resupply of subcomponents over component life time, rely on only single phase physics, and work independent of gravity. In Phase 1, Paragon demonstrated the potential of the membrane technology for use in the treatment of contaminated gas streams. Preliminary results indicate that the membrane is capable of generating a purified water vapor stream by extracting it from a second stream contaminated with hydrogen chloride gas as produced in lunar ISRU systems. In Phase 2, Paragon will perform the following: (1) Confirm lunar & Martian contaminants; (2) Predict performance and derive operating conditions / interface requirements of membrane and SOE units in ISRU systems via system analyses; (3) Experimentally verify impermeability of membrane to contaminants; (4) Demonstrate membrane performance does not hinder SOE performance through integrated testing; (5) Develop / test full scale membrane unit that meets ISRU requirements; and (6) Deliver additional membrane unit to NASA. At the end of the Phase 2 effort, Paragon aims to show that the membrane is impermeable to ISRU contaminants and integrates well with SOE. The technology will be advanced to a TRL of near 4 by designing / building a full scale unit that demonstrates water extraction at requirements specific to ISRU oxygen production systems.

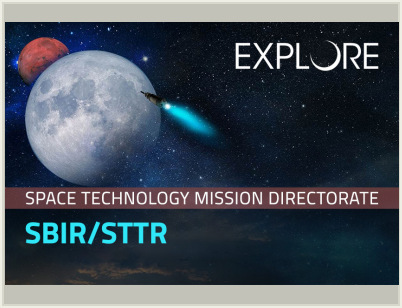

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Table of Contents

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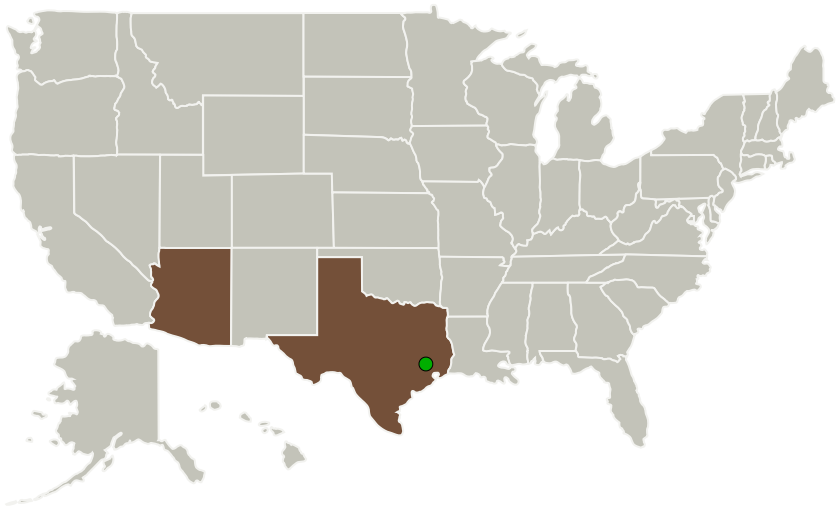
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Paragon Space Development Corporation	Lead Organization	Industry	Tucson, Arizona
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
Arizona	Texas

Project Transitions

June 2011: Project Start

January 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/138899)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Paragon Space Development Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

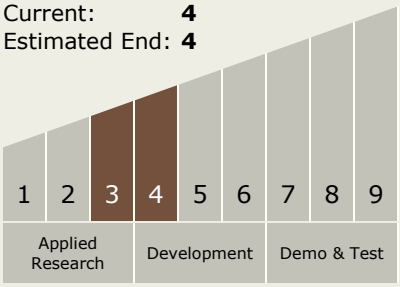
Carlos Torrez

Principal Investigator:

Sebastian Padilla

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX07 Exploration Destination Systems
  - TX07.1 In-Situ Resource Utilization
    - TX07.1.3 Resource Processing for Production of Mission Consumables

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System